Integrating Maize and Pigeonpea in Semi-arid Central, Tanzania

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Background

Yield advantages in intercropping is determined by the net effects of positive (facilitative and complementarity) interactions and mitigating negative (competitive) interactions (Kimaro et al., 2009). Pigeonpea plants have both physiological and morphological attributes that may reduce interspecific competition in mixed culture. The initial slow growth of pigeonpea relative to cereals minimizes competition in mixture, making pigeonpea compatible with most cereal-based systems (Snapp et al., 2002). In semi-arid areas, however, growing seasons are increasingly becoming shorter because of low and sporadic rainfall. Consequently, yield of intercropped pigeonpea may be adversely affected by competition, if farmers do not use appropriate agronomic practices. Pigeonpea is a fairly new legume crop in Kongwa and Kiteto district, requiring both adaptability studies (Work Package 1) and agronomy (Work package 2) studies particularly for sustainable intensification purposes. Thus, this study is being carried out to assess the component interactions and their impacts on farm productivity in order to provide guidelines for optimizing yields of maize and pigeonpea in semi-arid climates.

Objectives

1. To evaluate the effects of maize and pigeonpea intercropping under different spatial cropping arrangements on crop yields and wood supply.
2. To identify the spatial cropping arrangement for optimizing farm (crop and wood yields) productivity in Kongwa and Kiteto districts.

Material and Methods

The study was conducted at Mlali and Chitego villages in Kongwa District. We adopted a randomized complete block design with three replications. Treatments were various intercropping arrangements of maize and pigeonpea (Fig. 1): Pure stand, alternate rows of maize and pigeonpea (1:1), 1-maize row and 2 piegonpea rows (1:2), two maize rows and one pigeonpea row (2:1). Spacing of pigeonpea was 30cm x 120cm (pure stand) and for maize was 60cm x 90cm. Pigeonpea variety ICEAP0057) was selected by farmers based on superior growth and grain yield during the PVS trials in 2013 (WP 1)

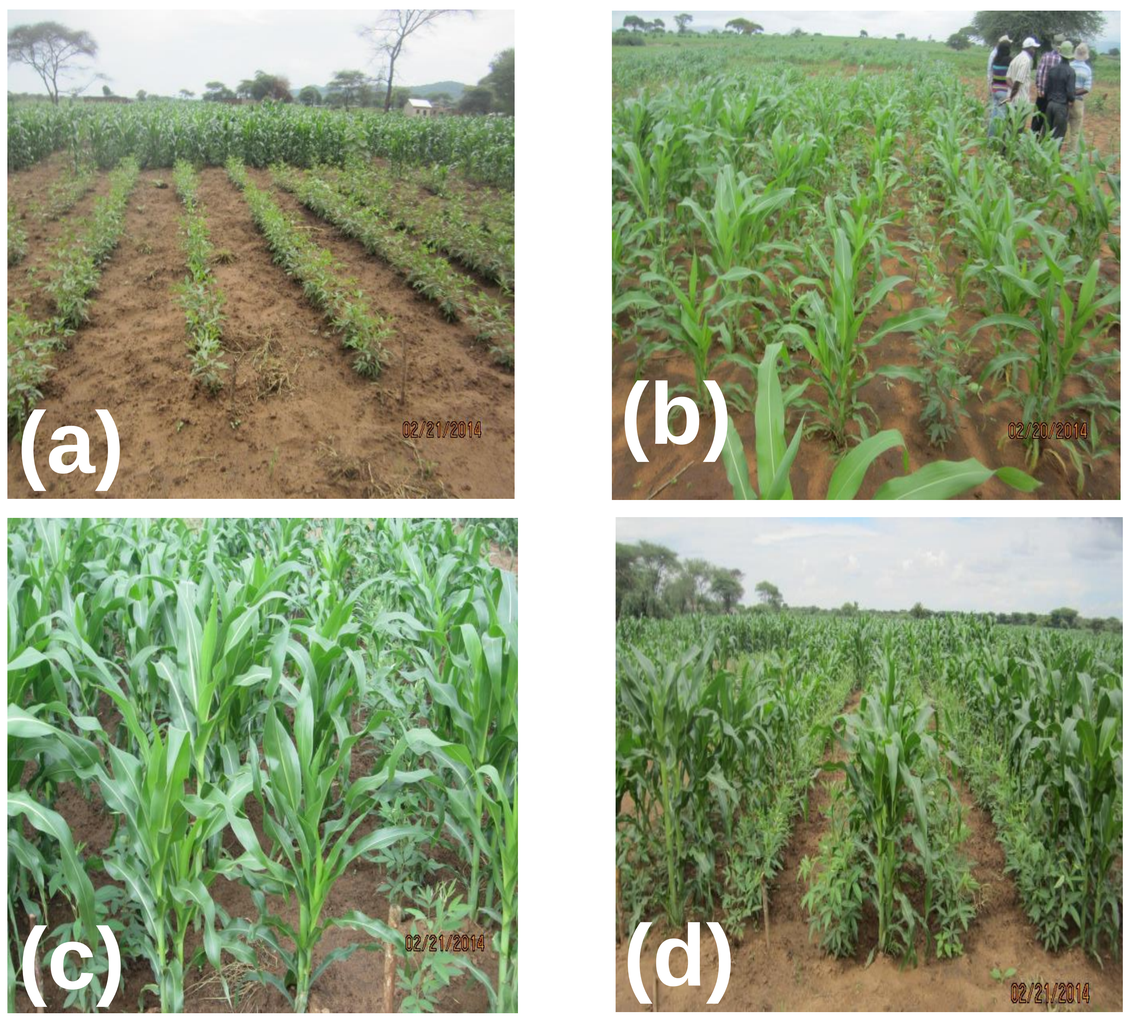

Fig. 1. Pure stands (a) and alternative - 1:1 (b), 2:1 (c) and 1:2 (d) spatial arrangements of rows of maize and pigeonpea.

Results and Discussion

Maize grain yield

Overall maize grain yield ranged from 1.2-2.04t/ha in Mlali and from 1.5-3.29t/ha in Chitego, reflecting higher potential in the latter site (Fig. 2). Relative to monoculture, yield of maize was reduced (28-40% in Mlali and 28-53% in Chitego) by pigeonpea intercropping. As expected, the decline in maize yield with increasing pigeonpea ratio reflect interspecific competition. However, yield decline was not significant except for 1:2 ratio in Chitego. Benefits (grain yield and wood biomass) from the intercropped pigeonpea are expected to offset such yield losses as the price of pigeonpea grain is often higher than that of cereals. Also the scarcity of fuelwood in the study sites increases the value of woody biomass from piegeonpea as most farmers use crop residues for cooking.

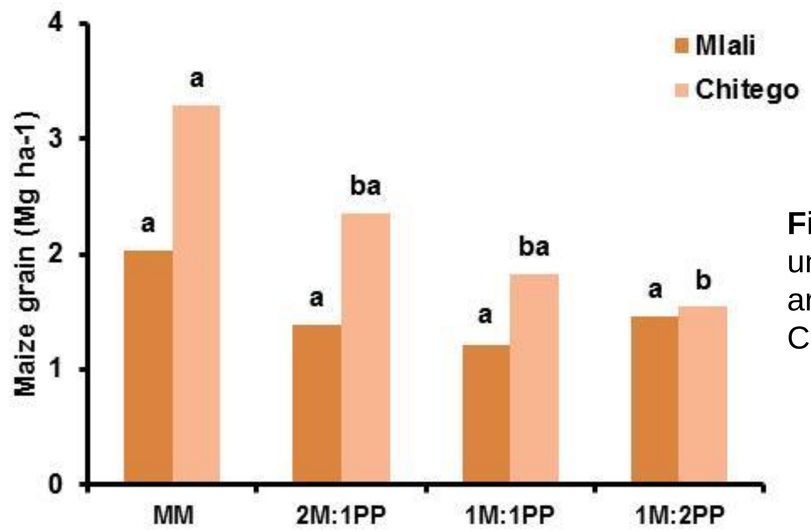

Fig. 2: Maize grain yield under different cropping arrangements at Mlali and Chitego Villages

Rootcollar Diameter of Pigeonpea

In both Mlali and Chitego, rootcollar diameter of pigeonpea was the highest in pure stand and the lowest in the alternate planting combination (Fig. 3). Relative to monoculture, the rootcollar diameter in mixture was reduced by up to 39% and 55% in Mlali and Chitego, respectively. No difference in the diameter growth was noted in the tested cropping arrangements, suggesting similar potential to produce wood since stem diameter correlates positively with wood biomass. However, results of pegionpea wood and grain yield are not yet available to assess yields at a farm level based on the land equivalent ratio (LER).

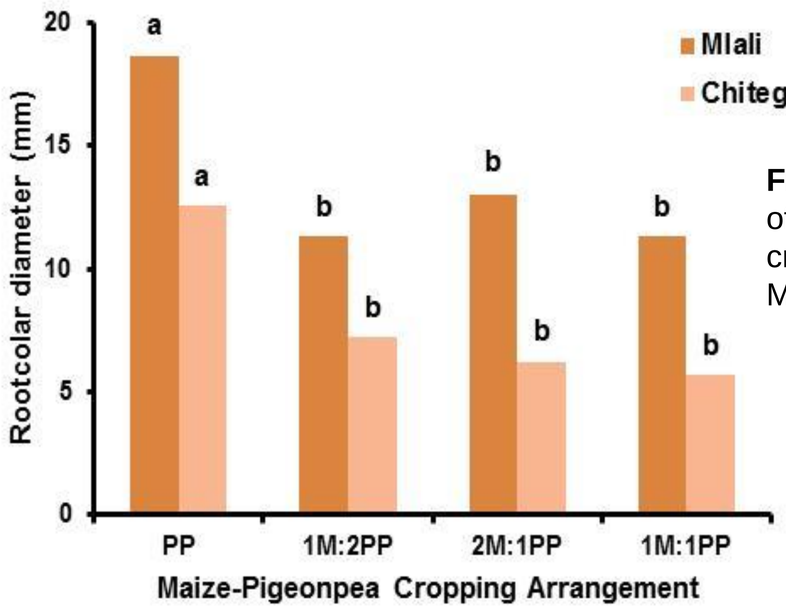

Fig. 3: Rootcollar diameter of pigeonpea under different cropping arrangements at Mlali and Chitego Villages

Conclusions

Preliminary results suggest that growth and yield of individual components can be reduced under intercropping but these losses may be offset by diversified products from the intercrops when farm level productivity is assessed. Data on pigeonpea grain yield and woody biomass are not yet available to conduct this analysis and hence identify the cropping arrangement which will optimize production

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